REMARKS

The Examiner is thanked for his careful and very thorough Office Action. The Examiner is particularly thanked for the helpful suggestions regarding correction of the alleged informalities. Claims 15, 16, and 19-21 are allowed. Claims 1-7, 9-14, and 17 have been rejected. By the foregoing amendments, various Claims are sought to be amended or canceled without prejudice. Note that the amendments to Claims 14 and 16 are intended to be purely formal amendments, and are believed not to change the scope of these claims.

The Examiner has stated that Claims 8 and 18 would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claim. By the foregoing amendments, Applicant has amended Claims 8 and 18 as suggested by the Examiner, and their allowance is respectfully requested.

Claims 1, 3, 5, 9, 12, and 13 are arguably being narrowed at this time. However, Applicant is not disclaiming nor permanently relinquishing any subject matter, and reserves the right to prosecute such claim scope further in a continuing application.

The foregoing amendments to the specification are submitted to improve clarity, and to remove various typographical and other minor informalities. These changes are respectfully asserted not to introduce new matter, and their entry is respectfully requested.

Art Rejections

The art rejections are all respectfully traversed.

Review of the References

Dublin, Jr. and *Zaleski et al.* both teach instrumented bits. *Dublin, Jr.* has nothing to do with detecting bit failure. Neither reference appears to have anything to do with changes in relative strain values.

Rejections Under 35 USC 102(b)

Claims 1-6 and 9-14 stand rejected under 35 USC Section 102(b) as anticipated by Dublin, Jr.

Claim 11 has been canceled without prejudice by the above amendment to expedite prosecution. The rejection of this claim is traversed and is now believed to be moot.

Dublin, Jr. measures axial forces indicative of weight on bit, as well as other factors, during vertical or highly deviated drilling. *Dublin, Jr.* merely measures strain resulting from these forces and is concerned only with drilling efficiency. This reference does not suggest, much less teach, a method of detecting drill bit failure or signaling the surface operator of possible impending drill bit failure.

Therefore, Applicant respectfully submits that Claims 1-6, 9, 10, 12-14 are not anticipated by *Dublin, Jr.*

The claim language of amended Claim 1 is not met. Specifically, Claim 1 recites "**circuitry for calculating relative changes in strain between said sensors**." The basis for the circuitry can be found in Figures 17-18 and pages 28-30 of the present application. *Dublin, Jr.* does not disclose or suggests a circuitry for calculating relative changes in strain between the sensors. This reference is directed at drilling efficiency, not at determining the actual condition of the drill bit. Therefore, the relative changes in strain among the sensors are not even considered by this reference.

According to the Federal Circuit:

> **For a prior art reference to anticipate a claim, the reference must disclose each and every element of the claim with sufficient clarity to prove its existence in the prior art.**

Motorola, Inc., v. Interdigital Tech. Corp., 43 USPQ 2d 1481, 1490 (Fed. Cir. 1997). Therefore, a prima facie case of anticipation

has not been established by the Examiner. Accordingly, Applicant respectfully requests withdrawal of this rejection.

Amended Claim 3 also recites features not shown or suggested by *Dublin, Jr.* Specifically, Claim 3 recites "**circuitry for calculating relative average strain among said sensors**." As with the relative changes in strain among the sensors, *Dublin, Jr.* does not disclose or suggests a circuitry for calculating the relative average strain among the sensors. The relative average strain among the sensors is not considered or even mentioned in this reference. Therefore, for the reasons discussed above, Applicant respectfully requests withdrawal of this rejection.

Amended Claim 5 also recites features not shown or suggested by *Dublin, Jr.* Specifically, Claim 5 recites "**circuitry for calculating average load supported by each of said cones**." *Dublin, Jr.* does not disclose or suggests a circuitry for calculating the average load supported by each of the cones. The average load supported by each of the cones is not considered or even mentioned in this reference. Therefore, for the reasons discussed above, Applicant respectfully requests withdrawal of this rejection.

Amended Claim 9 also recites features not shown or suggested by *Dublin, Jr.* Specifically, Claim 9 recites "**circuitry for calculating average load supported by each of said cones**." *Dublin, Jr.* does not suggest or disclose a circuitry for calculating average load supported by each of the cones. Therefore, for the reasons discussed above, Applicant respectfully requests withdrawal of this rejection.

Amended Claim 12 also recites features not shown or suggested by *Dublin, Jr.* Specifically, Claim 12 recites "**dynamically assessing degradation of said bottom hole assembly**." *Dublin, Jr.* is not concerned with assessing the degradation of a bottom hole assembly. It is directed at dynamically determining the weight on bit. Accordingly, it does not disclose or suggest a method for assessing the degradation of a bottom hole assembly. Therefore, for the reasons discussed above, Applicant respectfully requests withdrawal of this rejection.

Claim 13 also recites features not shown or suggested by *Dublin, Jr.* Specifically, Claim 13 recites "**dynamically assessing and signalling degradation of said bottom hole.**" As previously stated, this reference does not disclose or suggest a method for dynamically assessing degradation of a bottom hole assembly, much less signalling degradation. Therefore, for the reasons discussed above, Applicant respectfully requests withdrawal of this rejection.

Finally, dependent Claims 2, 4, 6, 10, and 14, which depend directly from independent Claims 1, 3, 5, 9, and 13 and incorporate all the limitations thereof, also include additional limitations that are not shown or suggested by *Dublin, Jr.*

Claim 2 recites "**relative changes in strain between said sensors is used to determine bit condition.**" As stated earlier, *Dublin, Jr.* is concerned with drilling efficiency and is directed at determining the actual weight on the bit. Therefore, it does not take into consideration the relative changes in strain between the sensors.

Claim 4 recites "**relative average strain among said sensors is used to estimate the drill bit condition.**" As with the relative changes in strain between the sensors, *Dublin, Jr.* does not consider, much less calculate and utilize, the relative average strain among the sensors in estimating drill bit condition.

Claim 6 recites "**changes in average bending moment are used to ascertain drill bit condition.**" *Dublin, Jr.* does not suggest or disclose calculating or utilizing changes in average bending moment to ascertain drill bit condition.

Claim 14 recites "**halting drilling in dependence on said step of dynamically assessing.**" *Dublin, Jr.* is only concerned with determining the dynamic weight on bit. Halting drilling is not even considered, much less disclosed, by this reference.

Thus, for these reasons, and for the reasons discussed above, Applicant respectfully requests withdrawal of this rejection.

Claims 1, 2, 5, 6, 7, 9, 10-14, and 17 stand rejected under 35 USC Section 102(b) as anticipated by Zaleski et al.

Claim 11 has been canceled without prejudice by the above amendment to expedite prosecution. The rejection of this claim is traversed and is now believed to be moot.

Zaleski et al. merely teaches an instrumented bit, and does not remotely suggest that sensors should be located anywhere except in the bit, nor that sensors should not be located in the bit. *Zaleski et al.* also does not teach relative changes in ratios. (Indeed, *Zaleski et al.* appears to teach away from the concepts described in the present application.)

Therefore, *Zaleski et al.* requires the use of a drill bit having sensors that are capable of communicating with the measurement and communication system. *Zaleski et al.* does not relate to having a sub assembly that operates independently of the sensors on the drill bit.

In fact, the present application specifically addresses the disadvantages of instrumented drill bits:

> **It appears that some work has been done on placing sensors directly in the drill bit assembly to monitor the bit condition. There is some merit in placing sensors in the bit assembly, but this methodology also has some distinct disadvantages. The main disadvantage is the necessity of redesigning every bit which will use the method. In addition to being costly, each new bit design will have to accommodate the embedded sensors which might compromise the overall design. A second disadvantage arises from the fact that sensor connections and/or data transmission must be made across the threaded connection on the bit to a data processing or telemetry**

unit. This is difficult in practice. (page 2, line 26 - page 3, line 6)

Therefore, Applicant respectfully submits that amended Claims 1, 2, 5, 6, 7, 9, 10, 12-14, and 17 are not anticipated by *Zaleski et al.*

The claim language of amended Claim 1 is not met. Specifically, Claim 1 recites "**circuitry to calculate relative changes in strain between said sensors.**" *Zaleski et al.* does not suggest or disclose a circuitry for calculating relative changes in strain between the sensors. This reference is concerned with the dynamic strain at each sensor. *Zaleski et al.* simply compares the amplitudes of the data signals to pre-established thresholds. It does not consider relative changes in strain between the sensors in predicting bit failure. Therefore, a prima facie case of anticipation has not been established by the Examiner. Accordingly, Applicant respectfully requests withdrawal of this rejection.

Amended Claim 5 also recites features not shown or suggested by *Zaleski et al.* Specifically, Claim 5 recites "**a plurality of sensors on the lower end of a drill string... circuitry for calculating changes in average bending moment of said lower end.**" As stated earlier, *Zaleski et al.* discloses an instrumented bit. This reference does not suggest or disclose locating sensors anywhere but in the drill bit itself. This reference also does not disclose or suggest a circuitry for calculating the average bending moment of the lower end of the drill string. Therefore, for the reasons discussed above, Applicant respectfully requests withdrawal of this rejection.

Claim 7 also recites features not shown or suggested by *Zaleski et al.* Specifically, Claim 7 recites "**plurality of sensors on the lower end of a drill string.**" Once again, *Zaleski et al.* discloses an instrumented bit. This reference does not suggest or disclose locating sensors anywhere but in the drill bit itself. Therefore, for the reasons discussed above, Applicant respectfully requests withdrawal of this rejection.

Amended Claim 9 also recites features not shown or suggested by *Zaleski et al.* Specifically, Claim 9 recites "**plurality of sensors on the lower end of a drill string... circuitry for**

calculating average load supported by each of said cones." *Zaleski et al.* does not suggest or disclose locating sensors anywhere but in the drill bit itself. This reference also does not disclose or suggest a circuitry for calculating the average load supported by each of the cones. Therefore, for the reasons discussed above, Applicant respectfully requests withdrawal of this rejection.

Amended Claim 12 also recites features not shown or suggested by *Zaleski et al.* Specifically, Claim 12 recites "**sensors located on a sub assembly located above the drill bit on the drill string.**" Therefore, for the reasons discussed above, Applicant respectfully requests withdrawal of this rejection.

Amended Claim 13 also recites features not shown or suggested by *Zaleski et al.* Specifically, Claim 13 recites "**sensors located on a sub assembly located above the drill bit on the drill string.**" Therefore, for the reasons discussed above, Applicant respectfully requests withdrawal of this rejection.

Claim 17 also recites features not shown or suggested by *Zaleski et al.* Specifically, Claim 17 recites "**an instrumented sub assembly.**" Therefore, for the reasons discussed above, Applicant respectfully requests withdrawal of this rejection.

Finally, dependent Claims 2, 6, 10 and 14, which depend directly from independent Claims 1, 5, 9, and 13 and incorporate all the limitations thereof, also include additional limitations that are not shown or suggested by *Zaleski et al.*

Claim 2 recites "**relative changes in strain between said sensors is used to determine bit condition.**" *Zaleski et al.* does not calculate or utilize relative changes in strain between the sensors to determine bit condition.

Claim 6 recites "**changes in average bending moment are used to ascertain drill bit condition.**" *Zaleski et al.* does not calculate or utilize relative changes in average bending moment to determine bit condition.

Claim 12 recites "**sensors located on a sub assembly located above the drill bit on the drill string.**" As stated earlier, *Zaleski et al.* does not suggest or disclose locating sensors anywhere but on the drill bit itself.

Claim 14 recites "**halting drilling in dependence on said step of dynamically assessing.**" *Zaleski et al.* does not suggest or disclose a method of halting drilling.

Thus, for these reasons, and for the reasons discussed above, Applicant respectfully requests withdrawal of this rejection.

Conclusion

Thus, all grounds of rejection and/or objection are traversed or accommodated, and favorable reconsideration and allowance are respectfully requested. The Examiner is requested to telephone the undersigned attorney or Robert Groover for an interview to resolve any remaining issues.

Respectfully submitted,

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